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(54) **Improvements in abrasive and polishing sheets**

(57) An abrasive or polishing sheet with a textile material made from continuous filament multifilament yarn adhered to the reverse of the working face of the sheet, the free surface of the material being engagable by hooks. The material can be repeatedly adhered to a hooked carrier and removed therefrom.

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FIG. 1.

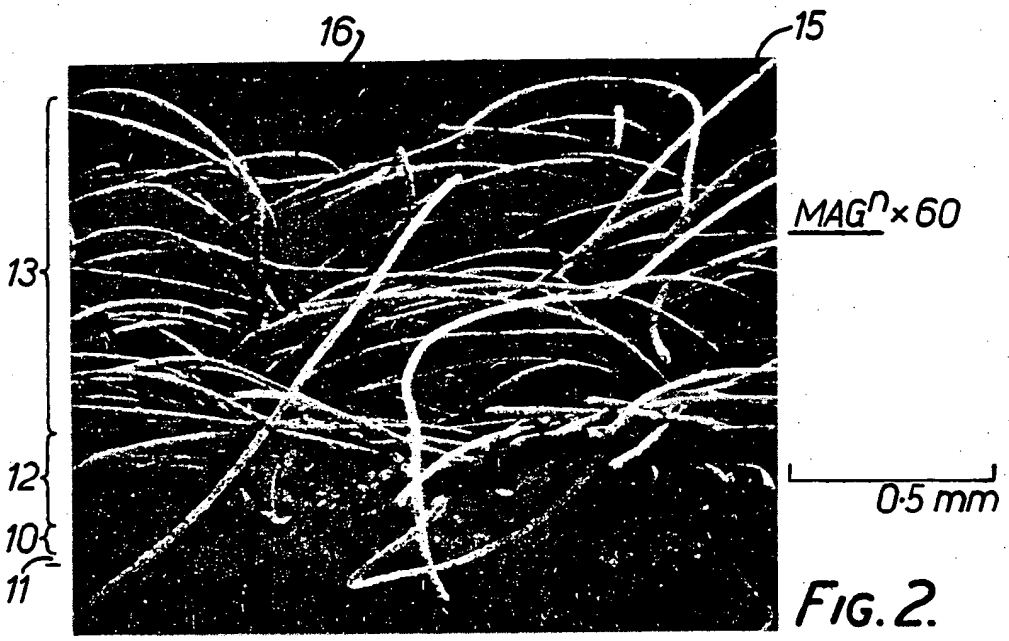

FIG. 2.

MAG^{n} × 30

1mm

FIG. 3.

16

MAG^{n} × 60

16

0·5mm

FIG. 4.

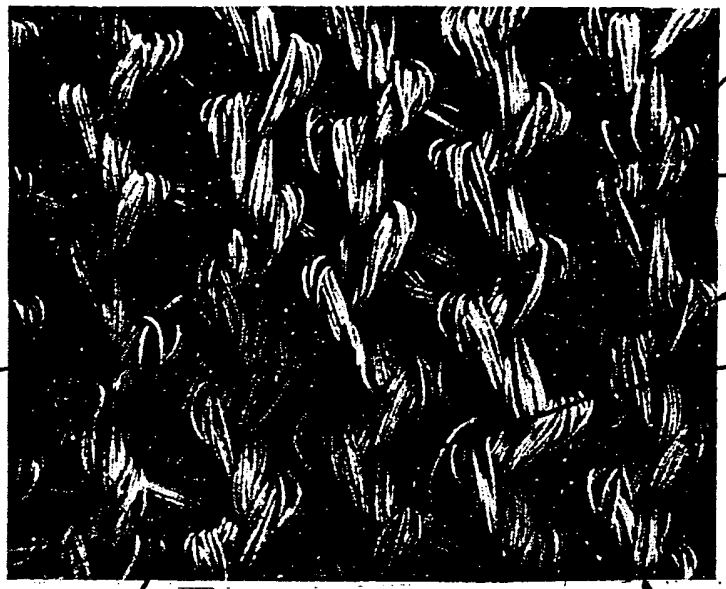

FIG. 5.

FIG. 6.

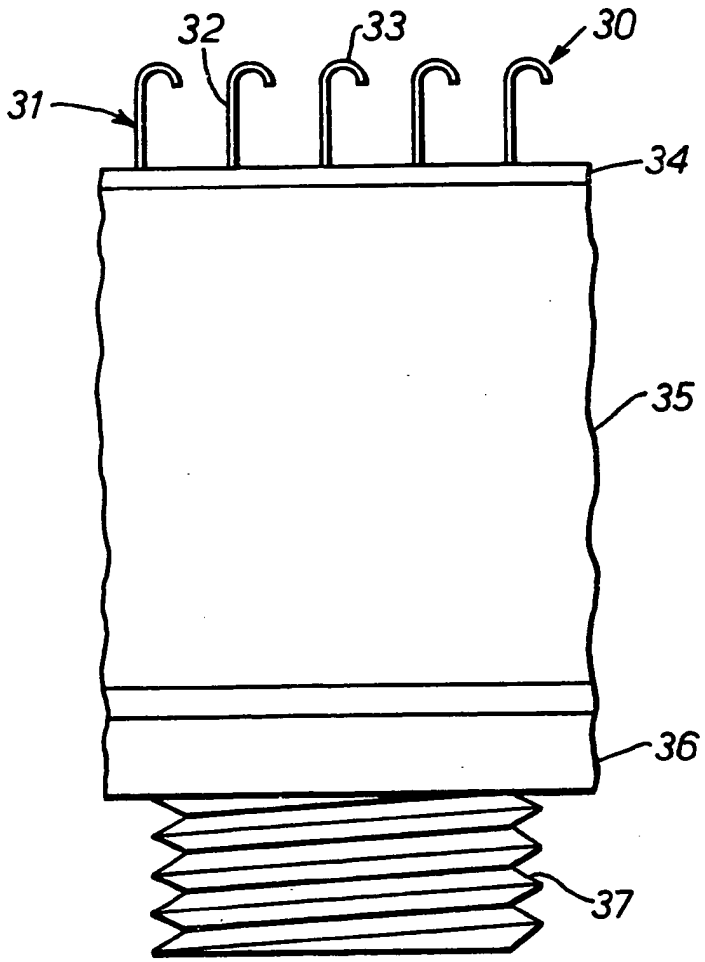

FIG. 7.

SPECIFICATION

Improvements in abrasive and polishing sheets

The present invention relates to abrasive or polishing sheets which can be readily exchanged for other sheets of different characteristics or for replacement when worn.

G.B. 1,205,267 discloses abrasive or polishing pads or discs replaceably attached to a carrier pad adapted to be mounted for rotation by a tool by providing the opposed surfaces of the disc and the pad with a plurality of interengagable self-locking fastening members. The tool carrier pad is provided with a plurality of hooks and the pads are provided with a looped mesh or fabric so that when the two are pressed together the loops fasten onto the hooks providing a self-locking fastening. A similar idea is described in G.B. 1,083,547. This uses a woven textile sheet which provides the hooks and this is attached to the polishing head by means of a solvent activated precoating. The pad has a textile sheet providing the loops attached to the reverse of the polishing side of the pad.

We have attempted to use conventional fasteners of this type but the looped fabric is usually about 2 or more mms thick and too bulky for this use. Such material tends to lessen the working life of the abrasive or polishing sheet, and they are also expensive.

We have now found surprisingly that thin light weight fabrics provide sufficient interlocking capability to attach to a hooked sheet on the carrier pad. Moreover thin light weight fabrics can be adhered to the disc readily with adhesives.

The present invention provides an abrasive or polishing sheet with a textile material made from continuous filament multifilament yarn adhered to the reverse of the working face of the sheet, the free surface of the material being engagable by hooks, and preferably having a peel strength (as defined herein) of at least 100 grams.

The sheet of the present invention can be used with a carrier unit provided with a plurality of hooks adapted to removably engage the engagable fibres or loops of the preferred textile material on the sheet whereby it can be removably attached to the carrier unit or pad. The sheet is readily and easily removable and replaceable on the carrier by means of the plurality of engagable fibres of the textile material on the sheet forming a selflocking fastening with the plurality of hooks on the carrier.

The peel strength between the textile material and the hooked material clearly must be less than that of the textile material to the working sheet or the hooked material to the carrier pad but must be sufficient to ensure adherence under all the working conditions and only to permit disengagement by a deliberate peeling operation.

The textile material may be a knitted fabric e.g. weighing not more than 150 grams/sq metre e.g. in the range 25 to 100 grams/sq metre. The fabric is preferably less than 1 mm thick.

One type of satisfactory textile material is one made from multifilament yarn in which individual filaments extend upwards from the plane of the fabric with their ends trapped within the yarn so as to provide an engagable portion of fibre which is engaged by a hook and will provide an interlock between the textile fabric and the hooked carrier unit. The engagable portions may extend out of the general plane of the fabric by 1, 2, 3, 4 or 5 or more times the thickness of the fabric. Thin clear adhesives are satisfactory. Foamed adhesives may also be used. The fact that the hook elements are permanently attached to the mounting or carrier element is of no great disadvantage because the hook elements do not undergo much wear and are not in need of frequent replacement. The sheets with the abrasive or polishing surfaces on the other hand need to be frequently replaced either because they have been worn out or because a different grading or grit size of sheet is required in the sequence of one job. If the sheet is removed because a different grading or grit size is required it may be kept on one side and reused again.

The invention may be put into practice in various ways and one specific embodiment will be described to illustrate the invention with reference to the accompanying drawings in which

Figure 1 is a magnified photomicrograph of a cross-section through an abrasive disc in accordance with the invention at approximately 30 fold magnification,

Figure 2 is an enlarged view of part of Figure 1 at approximately 60 fold magnification,

Figure 3 is a plan view of the top free surface of the fabric shown in Figures 1 and 2 at the same magnification as Figure 1,

Figure 4 is an enlarged view of Figure 3 at the same magnification as Figure 2,

Figure 5 is a plan view of the other side of the fabric to that shown in Figures 3 and 4 before it was glued to the abrasive disc,

Figure 6 is an enlarged view of Figure 5 at the same magnification as Figure 2, and

Figure 7 is a diagrammatic scrap cross-section along a line parallel to a row of hooks, showing only one row, of a carrier unit satisfactory for use with the disc of the present invention.

The photomicrographs of Figures 1 to 6 were taken on a scanning electron microscope. The photomicrographs of Figures 1 and 2 were prepared by cutting a clean cross-section through the sheet samples. The surfaces to be viewed were then coated with a thin metallic, e.g., gold or palladium reflecting layer as is conventional in preparing samples for electron photomicrography. A stream of electrons was then directed onto the cut surface at 45°C and the electrons reflected from the surface also at 45°C were collected and used to produce an optical image which was photographed. It will be appreciated that the depth of focus of such photographs is very much greater than in optical photography and thus that in effect one is able to see into the interior of the fabric.

EXAMPLE

A thin paper sheet had 100 mesh abrasive grit applied to one face. A thin clear conventional adhesive for laminating fabric to paper was then applied over the rear face.

A thin textile fabric was then adhered to the adhesive coated sheet, the adhesive dried and the sheet cut into discs or strips. The discs are used for rotary sander pads and are cut to preferably have a slightly larger diameter than the pads with which they are to be used. Strips are used for orbital sanders which have a rectangular abrasive sheet.

The free surface of the fabric was then printed with the grit size and any other data required such as the manufacturer's name, trade mark and grading code for the product.

The textile fabric was made from multifilament yarn having a thickness of 0.1 to 0.2 mms. The fabric weighed 67 grams/sq metre and was about 0.3 to 0.4 mm thick. The fabric had a soft furry raised side and a smooth glazed side which was attached to the paper. The smooth side hardly adhered at all to the hooked pad described below whilst the furry side adhered very well.

Figures 1 and 2 and 3 and 4 are side elevation and plan views of the material showing the raised side of the material with its other surface adhered to the abrasive carrying paper sheet.

Figures 5 and 6 are plan views of the smooth side of the fabric.

Referring to Figure 2 the various regions of the structure are indicated up the side of the Figure, the paper support sheet by the reference numeral 10, the abrasive coating by the reference 11, the main structure of the fabric by the reference 12 and the raised hook engagable portion of the fabric by the reference 13. This portion 13 as can be seen in Figure 2 is about 5 times the thickness of the main structure 12 though some filaments e.g. 15 extend out considerably further — as can be seen in Figure 1.

As can be seen from Figures 3 and 4, the plan views, this portion of the fabric is made up of fibres teased out of the main portion of the fabric but these teased out fibres 16 generally seem to have both ends retained within the fabric. These fibres are largely shown as white fibres in Figures 3 and 4, fibres buried deeper in the fabric appearing pale grey and yet deeper dark grey.

The structure has a random appearance the teased out fibres crossing each other and not being arranged in any readily discernible pattern.

Referring now to Figures 5 and 6 it will be observed that the basic structure of the fabric is highly ordered and is made up from a multifilament yarn, there being about 10 to 20 filaments in each yarn or more broadly at least 5 e.g. 5 to 40. Each filament appears to be essentially continuous monofilament, very few free filament ends e.g. 17, 18 and 19 being observable in Figure 5 and 6. The yarns appear to be knitted.

There are about 4 or 5 rows 21 per 3 mms i.e. 12 to 20 per cm and 8 or 9 knots 20 per 3 mms in a direction perpendicular to the rows in the plane of the fabric i.e. about 20 to 40 knots or stitches per cm along each row 21.

Each filament is about 0.015 mms (15 microns) in diameter, more broadly 5 to 50 microns in diameter.

A hooked pad which can be used with the discs of this invention has rows of stiff fibre, e.g. nylon, hooks extending up from its surface, the hooks being 1.5—2 mm high and of the shape shown in Figure 7.

Figure 7 shows a row 30 of hooks 31 each having a stem 32 and a head and hook 33. The stems are secured in a backing sheet 34 which is adhered to a foamed rubber pad 35 which itself is carried on a hard plastic mount 36. A screw threaded boss 37 for attachment to the rotary tool is located in the mount 36. The hook threads or stems are about 0.1 mm thick. The hooks are arranged in rows 5 rows per cm and there are 7 hooks per cm in each row. The hooks are staggered from row to row.

The peel strength of the above fabric from the above hooked pad shown in Figure 7 was measured as follows.

A strip about 8 mms wide, when smoothed onto the hooked surface, was cut from the fabric at right angles to the selvedge. The fabric was smoothed onto the hooked surface at various orientations to the rows of hooks and pulled essentially at right angles from the surface using a spring balance. The strip was aligned at right angles, parallel to and at 45° to the rows of hooks. The load required to separate the fabric from the hooked pad was in the range 8 to 12 ozs. (230 to 340 grams). The load required to separate the smooth face of the fabric was only 2 to 2 ozs. (57 to 85 grams). Thus as mentioned above we prefer to use the face of a fabric which has a peel strength (as measured herein) of at least 100 grams or more preferably at least 150 grams and especially at least 200 grams so as to ensure that the dics is firmly adhered to the pad during use and is not liable to fly off under the centrifugal forces involved in use.

The fabric shown in Figures 1 to 6 has $18\frac{1}{2}$ courses per cm and $16\frac{1}{2}$ wales per cm.

CLAIMS

1. An abrasive or polishing sheet with a textile material made from continuous filament multifilament yarn adhered to the reverse of the working face of the sheet, the free surface of the material being engagable by hooks.

2. An abrasive or polishing sheet as claimed in Claim 1 in which the free surface has a peel strength (as defined herein) of at least 100 grams.

3. An abrasive or polishing sheet as claimed in Claim 1 or Claim 2 in which the surface engagable by hooks affords a multitude of individual filaments extending out of the yarn and upwards from the plane of the material with their ends trapped within the yarn.

4. An abrasive or polishing sheet as claimed in Claim 1, 2 or 3 in which the material is less than

0.4 mms thick and is made from yarn having a thickness of less than 0.2 mms.

5. An abrasive or polishing pad substantially as specifically described herein with reference to Figures 1 to 6 of the accompanying drawings.

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